[0081] Another method of the invention, illustrated conceptually in the flowchart of **FIG. 6C** involves associating a touch signal shape with a local minimum in touch-induced error present in the touch signal **640**. The touch-induced error may, for example, comprise damping effect errors and/or inertial effect errors. A touch signal corresponding to a touch on the touch screen is acquired **645** and a particular time at which the touch signal shape is present in the touch signal is determined **650**. Touch location is determined using touch signal information obtained at the particular time **655**.

[0082] A further method of the invention is conceptually illustrated in the flowchart of **FIG. 6D**. According to this method, a touch signal arising from a touch force on the touch screen is acquired **660**. A touch signal shape within an interval of the touch signal associated with maximum force is detected **665**. The interval associated with maximum touch force may begin with the first application of a touch and end at a time beyond the touch signal peak. In one example, the interval ends when the touch signal slope corresponds to a predetermined value. In another example, the interval ends when the touch signal falls below a predetermined magnitude. Touch location is determined using touch signal information measured in response to detection of the touch signal shape **670**.

[0083] In yet another approach of the present invention, a touch signal with an error related to the rate of change of the touch signal is acquired **675**. A particular time for obtaining touch signal information is detected based on the rate of change of the touch signal **680**. Touch location is determined using touch signal information obtained at the particular time **685**.

[0084] The methods illustrated in the flowcharts of FIGS. **6A-6E** are further illustrated by the graph of **FIG. 7**. **FIG. 7** illustrates an exemplary graph of a touch signal **700** representing a touch force with a typical profile and duration. Signals from one or more force sensors may be processed using a variety of filtering and/or processing techniques and combined to form the touch signal **700**. A decision that a touch event has begun may, for example, correspond to detection of a touch presence threshold point **705**. A touch signal shape **720** falling within an interval of maximum touch force **740** gives a location point **710** corresponding to a preferred time for obtaining touch location information, t_L. The touch signal shape corresponding to the preferred time for obtaining touch location information may be a predetermined slope of the touch signal, for example. The interval associated with a touch signal maximum may begin at the time a touch is applied t_{INT1}, and end when the touch signal slope corresponds to a predetermined value **730** at time t_{INT2} following the touch force peak. Alternatively, the interval may end when the touch signal falls below a predetermined magnitude. The predetermined magnitude ending the interval may be selected to correlate to the time the touch is removed from the touch screen, for example.

[0085] The touch location measurement may be improved using low pass LTI filters, such as a FIR or IIR filters, for processing the touch signal. Filtering may be applied to the sensor signals or to linear combinations of the sensor signals such as the sum of the sensor signals representing the total touch force. Due to the need to suppress high frequency mechanical resonances, the LTI filters chosen may exhibit an impulse response broader than the duration of a typical tap touch. This may mean that for rapid touches wherein reducing the effects of touch induced noise is most important, the shape of the filtered touch signal profile corresponds closely to the filter impulse response. Filtering the touch signal in this manner may provide a degree of consistency and predictability to rapid touch signals with the highest component of touch induced error. Further, the shape of rapid touch signals may be controllable to some degree by selection of a particular filter impulse response. The ability to control and predict the shape of rapidly changing touch signal may lead to simpler and more effective determination of the preferred time for touch location measurement. For example, when all forms of touch induced noise are considered, the point of highest signal to noise ratio may occur at a point slightly removed from the peak. With a tap touch creating a consistent filtered touch signal profile, the preferred time may be obtained at a specified time offset from the peak, or a specific non-zero value of the relative slope.

[0086] According to various embodiments of the invention, a preferred time for a touch location measurement may be determined by several methods illustrated in FIGS. **8-11**. In one embodiment, illustrated in the flowchart of **FIG. 8**, the preferred time may be taken to be the first time that the relative slope drops below a predetermined value. As illustrated in **FIG. 8**, the touch signal is sampled **810** and the relative slope is calculated **820** by the method previously discussed. When the relative slope falls below a predetermined value **830**, the touch location measurement is made **840**.

[0087] In another embodiment, illustrated in **FIG. 9**, the preferred time for the touch location measurement may be the peak value of the touch signal. Determining a preferred time for touch location measurement based on detection of a peak may be embodied in several ways. The first time derivative of the time profile may be approximated by subtracting the total force measured at time, t_1, from the total force measured at a slightly later time, t_2. The relative slope may then be taken as the ratio of this difference to the total force at time t_2.

[0088] In one embodiment, the preferred time for touch location measurement is the point at which the relative slope, or equivalently in this case, the absolute slope, changes sign from positive to negative indicating the touch signal peak. The touch signal is sampled **910** and the relative slope is calculated **920**. Initially, as the touch signal rises, the relative slope is positive. When the relative slope becomes negative **930**, the peak is detected and the touch location measurement is made **940**.

[0089] The flowchart of **FIG. 10** illustrates another embodiment, wherein the preferred time may be taken to fall halfway through the greatest interval for which the absolute value of the relative slope is below some predetermined value. The touch signal is sampled **1010** and the relative slope is calculated **1020**. In response to the relative slope of the touch signal falling below a predetermined value **1025**, the touch signal value is stored **1030**. The touch signal is sampled **1035** and the touch signal values are stored **1030** according to the loop defined by steps **1030-1050** so long as the relative slope calculated at step **1045** is below a predetermined value **1050**. When the relative slope is greater than or equal to the predetermined value **1050**, the preferred time for making the touch location measurement is determined as